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BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION. XXXVII[1]

ON PAN-ANTARCTIC TERNS

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In the course of identification of terns collected during the Whitney South Sea Expedition at islands near New Zealand, it became apparent that a revision of all the Pan-Antarctic representatives was desirable. This seemed the more urgent because some of the conclusions drawn in the discussion of several forms in my 'Oceanic Birds of South America' (1936: pp. 1099–1114) have proved untenable.

The present study has been facilitated by an opportunity to examine most of the important specimens belonging to European collections, and by the recent publication of Falla's masterful volume on the birds of the B. A. N. Z. Antarctic Research Expedition of 1929–1931 (1937).

THE PAN-ANTARCTIC ZONE

The Pan-Antarctic marine zone may be defined as the area lying between the Sub-Tropical Convergence and the shores of the Antarctic Continent. There are, however, two distinct geographic usages in the classification of the southern circumpolar areas. That developed by the oceanographers of the Discovery Committee of the British Colonial Office (Deacon, 1937: Fig. 4) is the one followed in 'Oceanic Birds of South America.' The usage adopted among German oceanographers differs from this (Schott, 1935: p. 163) in that the Antarctic Zone comprises two subdivisions, a Sub-Antarctic and an Antarctic, while the Sub-Antarctic Zone of the British school is designated the Zone of Mixed Waters. Both systems agree in the designation and position of the Sub-Tropical Zone, but the slightly different course that each assigns to the Sub-Tropical Convergence, as represented in recent publications by Hart and Schott, respectively, has an important bearing upon the present problem.

[1] Previous papers in this series comprise American Museum Novitates, Nos. 115, 124, 149, 322, 337, 350, 356, 364, 365, 370, 419, 469, 486, 488, 489, 502, 504, 516, 520, 522, 531, 590, 609, 628, 651, 665, 666, 709, 714, 820, 828, 912, 915, 933, 939, and 947.

At any rate, the Pan-Antarctic represents the Antarctic and Sub-Antarctic belts of the British system, and the Antarctic and Zone of Mixed Waters of the German system. The terns falling within this field include one species (*Sterna paradisaea*) which is a seasonal migrant from the northern hemisphere to the southern oceans; another (*Sterna virgata*) which is endemic at certain islands lying on or near the Antarctic Convergence; and a third (*Sterna vittata*) which is of wide distribution throughout the Pan-Antarctic Zone. The last species breaks up into several local subspecies, one of which extends its breeding range north of the position assigned by the 'Discovery' authors to the Sub-Antarctic Convergence, or as far as islands which they would relegate to high latitudes of the Sub-Tropical Zone, namely, St. Paul and Amsterdam, in the southern Indian Ocean.

THE ZONAL STATUS OF ST. PAUL AND AMSTERDAM ISLANDS

Hart (1937: Figs. 2–4) shows the probable average positions of the Sub-Tropical and Antarctic Convergences in south polar projection, as they have been deduced from the 'Discovery' investigations. In this plotting, St. Paul and Amsterdam lie to northward of the Sub-Tropical Convergence. Schott (1936: Pl. XXIV), however, lays the course of this convergence across the southern Indian Ocean on a trend which brings St. Paul and Amsterdam just south of it. The latter relationship is in harmony with the biotic observations of Vélain (1877). Giant kelp (*Macrocystis pyrifera*) is even more luxuriant at these islands than at Tristan da Cunha. Hart (p. 417) reports that the 'Valdivia' Expedition obtained a typically sub-antarctic "indicator" diatom at St. Paul Island. Zonal birds common to St. Paul, Amsterdam, Gough, and Tristan include a penguin (*Eudyptes crestatus*), two albatrosses (*Phoebetria fusca* and *Diomedea chlororhynchos*), the broad-billed whale-bird (*Pachyptila forsteri*), and a form of one of the terns discussed in this paper (*Sterna vittata*).

The conclusion would seem to be that St. Paul and Amsterdam are categorically sub-antarctic rather than sub-tropical. Their biogeographic affinities are clearly with Tristan da Cunha rather than with the much less distant island of Kerguelen, a fact revealed in the vegetation no less than in the native animal life. That there should still be differences of opinion regarding the zonal status of St. Paul and Amsterdam only emphasizes a fact pointed out by James (1936: p. 667), namely, that the failure of the strictly hydrologic divisions of the world

ocean to coincide fully with biologic, climatic, or other natural regions offers a fruitful field for analytic investigation.

SPECIMENS OF PAN-ANTARCTIC TERNS EXAMINED

The generous coöperation of my colleagues in many other institutions has enabled me to bring together much important, and some historic, material for direct comparison. Dr. Erwin Stresemann, in particular, has not hesitated even to send pertinent type specimens from Berlin to New York. The Rothschild Collection, now part of that of The American Museum of Natural History, has also been of particular aid. All of the pan-antarctic terns studied are listed below, with credit to the sources. The adopted nomenclature is explained in the subsequent systematic section.

Sterna virgata	
Amer. Mus. Nat. Hist.	1, Kerguelen Island
U. S. Nat. Mus.	4, " "
Zoöl. Mus. Berlin	6, " "
British Mus.	6, " "
Sterna paradisaea	
Royal Scottish Nat. Hist. Mus.	1, 64° 38′ S., 35° 13′ W.
	1, 68° 32′ S., 12° 49′ W.
British Mus.	2, 66° S., 157° W.
Zoöl. Mus. Berlin	1, 56° S., 66° E.
	4, 66° S., 91° E.

The last four specimens are the type and cotypes of the "*Sterna macrura antistropha*" of Reichenow.

Sterna vittata vittata	
Amer. Mus. Nat. Hist.	1, Kerguelen Island
British Mus.	1, " "
Sterna vittata tristanensis	
British Mus.	3, St. Paul Island
	2, 36° 56′ S., 35° E.
	1, Gough Island
	2, Tristan da Cunha
	1, 35° S., 0° 30′ E.
Sterna vittata bethunei	
Amer. Mus. Nat. Hist.	5, Antipodes Islands
	2, Bounty Islands
	2, Campbell Island
	1, Chatham Islands (?)
	3, Snares Islets
Mus. Comp. Zoöl.	1, " "

Sterna vittata georgiae
Amer. Mus. Nat. Hist. 18, South Georgia
Zoöl. Mus. Berlin 22, " "
Sterna vittata gaini
Amer. Mus. Nat. Hist. 4, South Shetland Islands
Sterna vittata macquariensis
Described by Falla, August, 1937
No specimens seen

The above naturally include a proportion of ancient, sadly battered specimens, accompanied by more or less deficient data. Nevertheless, practically all of them are useful, and a number are of critical taxonomic interest. More serious as a bar to final conclusions than the condition of any of these 95 specimens is the fact that I have seen no terns whatsoever from the following pan-antarctic islands: South Orkneys, South Sandwich group, Bouvet, Prince Edward and Crozet groups, Heard, and Macquarie. Fortunately, Mr. Falla's publication has now supplied useful data on the resident terns of several of these localities.

THE ARCTIC TERN AND THE ANTARCTIC TERN

Of greatest general interest among the questions discussed in this paper, is the zoögeographic problem which concerns the range relationships of the two species of terns (*Sterna paradisaea* and *S. vittata*) known, respectively, by the vernacular names of the above heading. The subject has been discussed in 'Oceanic Birds of South America,' particularly on pp. 1102, 1103, 1107, and 1108, but the conclusions arrived at by both Gain (quoted on p. 1107) and myself have proved to be in part incorrect. A rectification is therefore of first importance.

I have now had the privilege of examining nine specimens of arctic terns collected between latitudes 56° and 68° S. The longitudes of the collecting stations fall, as noted in the foregoing list, within each of the four south polar quadrants, namely, the American, Indian, Australian, and Pacific. Further evidence would scarcely be required to show that the arctic tern does regularly migrate as far as the pack-ice belt of the southern oceans, and even across the Antarctic Circle.

In any event, the publication of Falla's paper has removed all doubt. Reporting upon the birds of Sir Douglas Mawson's British, Australian, and New Zealand Antarctic Research Expedition (1929–1931), of which he was a member, and upon those of the Australasian Antarctic Expedition (1911–1914), Falla (1937: pp. 251–254) writes that ten moulting adult arctic terns were collected in antarctic seas (beyond latitude 64° S., and between longitudes 84° and 118° E.) during the months of

January and February, 1931. Furthermore, birds of this species were encountered in large numbers in the pack ice to southward of latitude 54° S., and as far as longitude 150° E., throughout the antarctic summer period or from December to March.

Owing to the presence of a resident antarctic tern in sections of the same waters, particularly in those close to certain parts of the south polar continental shore, the need for caution, to which I have formerly called attention, still holds. We have no means of judging the reliability of sight records of arctic terns in the Far South unless they are correlated with the collection of specimens.

THE SPECIES AND RACES OF PAN-ANTARCTIC TERNS

Sterna virgata

Sterna virgata CABANIS, 1875, Journ. für. Ornith., XXIII, p. 449 (Kerguelen Island); FALLA, 1937, p. 255.

This tern, which is confined to islands and waters close to the Antarctic Convergence, is a strongly marked species, differing from *vittata* and the other terns of this paper in several or all of the following respects: mantle dark smoky gray, with the ventral surface scarcely lighter, so that the white moustachial streak stands in strong contrast with the gray chin and throat; wing lining distinctly gray instead of white; gray band occupying two-thirds of the breadth of the inner web on the outermost primary; outer webs of the tail streamers strongly gray, the other rectrices grayish rather than white; bill decidedly short, averaging somewhat less than in the smallest subspecies of *S. vittata*. Falla's excellent notes make further description unnecessary.

No taxonomic question is raised by this species because I have seen examples only from Kerguelen Island. The total extent of the breeding range of *virgata* is still problematical, and it seems to have grown "on paper" rather than through determination by field collecting. Saunders (1896: p. 50) lists 12 British Museum specimens from Kerguelen and one from the Crozets. The latter specimen does not appear among those sent to me from the British Museum, but Falla lists the species on "sight record" from the Crozets. Terns known to the old-time sealers as "king birds" are abundant at both the Crozet and Prince Edward groups, but specimens appear to be practically non-existent.

Saunders adds that the range of *virgata* includes "probably Heard Island." In later literature the tendency has been to drop the word "probably" and to extend the range still farther, but neither in Reichenow (1908: p. 562), Peters (1934: p. 334), nor Falla do I find anything

definitely to substantiate a Heard Island record. The question is important because Heard belongs to the deep antarctic belt. The distribution of *Sterna virgata* evidently needs further investigation. Apparently the species has never been taken at sea far from land, and it may prove to be a highly sedentary bird, peculiar to one or more groups of intermediate antarctic islands in the Indian quadrant.

At Kerguelen Island the ranges of *virgata* and *vittata* overlap. Falla has written, however, about an extraordinarily significant ecological difference between these two terns, which he discovered during the recent polar cruise. At Kerguelen *virgata* lays its two eggs during October and November, only to be replaced on the same nesting areas in January and February by *vittata*, which lays but a single egg. Thus interspecific competition is avoided during the nesting period. A further parting of the ways results from the fact that *virgata* is more or less of a land-feeder, capturing spiders, insects, etc., in the marshes of the inland hills, while *vittata* is exclusively marine. Such functional differences, discoverable not from specimens but only through painstaking field work, exemplify the light that remains to be thrown upon the interrelationships of pan-antarctic birds.

Among the 17 specimens I have examined, only three adults have sufficient data to permit comparison as to the relative size of the sexes.

2 males: wing, 260–265 (262.5); tail, 123.5; exposed culmen, 29.2–30.6 (29.9); tarsus, 17.8–18.9 (18.3); middle toe and claw, 24 mm.

1 female: wing, 253; tail, 129.1; exposed culmen, 29 mm.; (legs missing).

Sterna paradisaea

Sterna paradisaea PONTOPPIDAN, 1763, 'Danske Atlas,' I, p. 622 (Denmark); MURPHY, 1936, p. 1099.

Sterna macrura antistropha REICHENOW, 1904, Orn. Monatsb., XII, p. 47; 1904, Sitzungsb. Ges. naturf. Freunde, Berlin, XII, p. 172.

Sterna macrura, FALLA, 1937, p. 251.

As regards *S. paradisaea* and *S. vittata*—the arctic and antarctic terns—the remarkably close resemblance between adult stages of the two has often been pointed out. However, since *vittata* is represented in pan-antarctic waters by several subspecies of differing shades, sizes, and proportions, it is important to stress only the characters which invariably distinguish the two species as a whole. These are reduced to very few as follows:

The tarsus in *S. paradisaea* is relatively much shorter than in any form of *vittata*, and absolutely shorter than in the smallest race of *vittata*.

The plumage of *paradisaea* is of a lighter and more pearly gray, particularly on the ventral surface, than that of the palest race of *vittata*. The gray band next the shaft on the inner web of the outer primary is decidedly narrower in *paradisaea* than in the race of *vittata* which most closely approaches *paradisaea* in this respect. The outer webs of the lateral rectrices in *paradisaea* are dark gray, sharply contrasting with the white inner webs, a condition not quite duplicated in any form of *vittata*. Furthermore, the tail streamers are relatively longer and more slender in *paradisaea* than in any form of *vittata*.

In condition of plumage and in dimensions affected thereby, the nine examples I have examined of arctic terns from pan-antarctic waters, all of which were collected during the southern-hemisphere summer season, agree closely with migrant specimens from both coasts of South America. When compared with birds from northern-hemisphere breeding grounds, the antarctic examples naturally show prevailingly much shorter wings and tails. Falla's life-history observations fully explain this difference.

As noted heretofore, Falla found arctic terns abundant in the pack ice between Ross Sea and Enderby Land. The birds were in heavy moult; during December and January they perched on lumps of ice most of the time and flew unsteadily when driven up by gales and ice-movements (information *in litteris*). Such observations fully explain the comments by Vanhöffen and other German authors quoted in 'Oceanic Birds of South America.' The condition of specimens examined by Falla indicated that the moult would be completed, and breeding plumage assumed, toward the end of March.

The richer hue of bill and feet, emphasized by Reichenow when he described the antarctic birds as a new race (and subsequently as a new species), is regarded by Falla as due to a temporary excess of pigment in the antarctic moulting birds. He writes: "In our specimens rich liquid pigment could be pressed out from beneath the thin plates of the bill." A subsequent remark to the effect that the stomachs of the terns shot were filled with a red crustacean (*Euphausia*) may have causative significance in relation to the brilliantly colored bills and feet. Quite possibly the arctic terns find a richer source of red pigment in the principal pelagic food of their antarctic range than in any organism of the northern-hemisphere breeding range. One or more such pigments are known to withstand metabolic processes and to be redeposited in the tissues of the eater.

The nine antarctic specimens of the arctic tern that I have examined include no less than three—two males and one female—labelled as the

type of Reichenow's *antistropha!* One of the males is the specimen figured in color (1908: p. 463). Their dimensions are as follows:

4 males: wing, 257–265 (261); tail, 145.5; exposed culmen, 30.9–35.1 (32.5); tarsus, 15–16.4 (15.8); middle toe and claw, 21.7–23.2 (22.3) mm.

5 females: wing, 246–265 (258); tail, 129–165 (147.5); exposed culmen, 27.7–31 (29.5); tarsus, 15.4–17.3 (16); middle toe and claw, 19.1–24.2 (21.5) mm.

Sterna vittata vittata

Sterna vittata GMELIN, 1789, 'Syst. Nat.,' I, pt. 2, p. 609 ("Insula Nativitatis Christi" = Christmas Harbor, Kerguelen Island).

Sterna vittata vittata, FALLA, 1937, p. 258.

Kerguelen Island is the type locality of the species. The resident form is a race of intermediate size and relatively dark coloration. I have seen no examples from the nearest islands to westward and southward at which it has been alleged also to reside. Falla believes that he observed a form of this species at Heard Island but, unfortunately, none was collected there.

I have examined but two specimens, in which the breeding plumage may be described as follows:

Pileum and nape black; a white line, narrow above the commissure of the bill, broadening from the lower eyelid ventrad across the cheek, and outlining the black cap except at its caudad extremity; wing lining and tail, including the coverts of the latter, white, the outer webs of the rectrices washed with faint gray; remainder of body plumage close to the deep gull gray of Ridgway, and scarcely lighter on the ventral than on the dorsal surface; primaries with a silvered gloss of gray darker than that of the mantle, the outer web of the outermost blackish; shaft of the outermost primary clear white, those of the others slightly dulled or grayed; outermost primary with a deep neutral gray band, of some 4–5 mm. in width, on the inner web next the shaft, the corresponding bands broadening and extending on succeeding primaries which, in the same order, bear decreasing tongues of white on their inner webs; inner webs of proximal remiges mostly white, the secondaries also tipped and externally fringed with white, forming a single wing band. Bill, legs, and feet red, the bill in life being usually described as "coral," the feet as "blood" or "arterial" red.

Because of the grayness of Kerguelen birds, and also on general zoögeographic grounds, it is a mistake to assume that the typical subspecies of this tern inhabits such diverse breeding localities as Kerguelen, Heard, St. Paul, Amsterdam, and the islands of Tristan da Cunha. As a matter of fact, two adult females taken in mid-January in latitude 36° 56′ S., longitude 35° E. (southeast of the Cape of Good Hope), are considerably lighter in shade than the Kerguelen examples, and I have,

after due comparison, referred them to another race. Furthermore, it should be noted that the species *vittata* has not yet been certainly recorded from such islands as the Crozets, Prince Edwards, and Bouvet.

Falla has made the very interesting discovery that at Kerguelen this tern occupies the territory of *Sterna virgata* after the latter species has finished its breeding season. Corresponding stages in the life histories of the two species are, on the average, about two months apart.

A specimen of known sex measures as follows:

1 male from Kerguelen Island: wing, 265; tail, 137.7; exposed culmen, 34.2; tarsus, 17.3; middle toe and claw, 23.1 mm.

Sterna vittata tristanensis, new subspecies

Sterna melanorhyncha GOULD, 1865, 'Handb. Birds Australia,' II, p. 399 (*partim*, for egg from St. Paul Island).

Sterna sancti-pauli GOULD, 1865, *ibid.* (synonym for *S. melanorhyncha* = *S. striata*).

Sterna vittata, subspecies, MURPHY, 1936, p. 1113.

SUBSPECIFIC CHARACTERS.—Larger than typical *vittata*, and with longer tail streamers than any other race. Plumage of a lighter shade of gray throughout than in the typical race.

TYPE.—British Museum Register, 1906. 12. 21–20; ♂ ad.; Tristan da Cunha Island; January 17, 1906; Michael J. Nicoll.

RANGE.—Known from the islands of the Tristan da Cunha group and Gough Island, in the Atlantic, from St. Paul Island in the Indian Ocean, and from pelagic localities off South Africa.

The nine specimens I have examined from Tristan, Gough, St. Paul, and intervening oceanic areas all seem to represent one race, paler and larger than the birds of Kerguelen. It is the largest of all the races of *vittata*, in fact, except the form of West Antarctica (*gaini*). The outer rectrices are longer and narrower than in typical *vittata*, and the gray band next the shaft on the inner webs of the primaries is likewise narrower. The difference in the shade of gray characteristic of Kerguelen and Tristan specimens, respectively, cannot be expressed exactly by any terms with which I am acquainted. It approximates or approaches, however, the difference between "deep gull gray" and "gull gray" (samples 7 and 8 in the carbon gray series of Plate LIII, Ridgway, 1912).

It is very interesting that a uniform sub-antarctic environment encompassing, between Tristan and St. Paul, a quarter of the circumference of the world along the fortieth parallel of latitude, should be inhabited by a common subspecies and that the latter should prove to be

distinct from the tern confined to one or more islands near the fiftieth parallel. The distribution is thus in harmony with that of albatrosses, plants, and other organisms.

The type of this race was collected during the cruise of the Earl of Crawford's yacht 'Valhalla.' Other Tristan and Gough Island specimens in beautiful plumage were obtained by Wilkins on the return from the Antarctic of the 'Quest.' The localities of all the examples I have seen are listed on page 3. The alleged presence of this tern at St. Helena and Ascension has been shown to be erroneous (Murphy, 1936: pp. 109, 154, 1106), though it has been collected in various parts of the South Atlantic, particularly to westward of the Cape of Good Hope but also between St. Helena and Ascension and perhaps near the coast of southern Brazil.

This race has been the subject of a curious nomenclatural tangle. In 1865, Gould, regarding the specific name of *Sterna melanorhyncha* as "inappropriate," proposed the new name *sancti-pauli* for the Tasmanian tern now known as *S. striata*. A confusion of the Tasmanian species with a tern's egg from St. Paul Island caused his choice of the new name. My colleague, Mr. John T. Zimmer, informs me that under such circumstances *sancti-pauli* becomes solely a synonym of *striata* and that the tern of St. Paul, which is of another species and an undescribed subspecies, requires a new name.

6 males from Tristan da Cunha, Gough, and St. Paul islands and from latitude 35° S., longitude 0° 30′ E.: wing, 252–260 (254.7); tail, 163.3–183 (173.3); exposed culmen, 36.3–37.7 (37.1); tarsus, 19.5–19.8 (19.7); middle toe and claw, 26.3–27 (26.6) mm.

3 females from Tristan da Cunha and from latitude 36° 56′ S., longitude 35° E.: wing, 260–267 (263.3); tail, 161–179.2 (168.8); exposed culmen, 34.6–36.2 (35.5); tarsus, 18.4–20 (19.2); middle toe and claw, 25.9–27.1 (26.5) mm.

Sterna vittata macquariensis

Sterna vittata macquariensis FALLA, 1937, 'B. A. N. Z. Antarctic Research Exp. 1929–1931, Reports'—Series B, II, p. 260 (Macquarie Island).

Falla has published the first useful systematic notes on the resident tern of Macquarie Island, of which 17 skins were collected in 1912 and 1913 during the Australasian Antarctic Expedition.

I have seen no specimens. The stated diagnostic characters of the subspecies are not sufficient, in the absence of an opportunity for comparison, to separate this race with certainty from the one inhabiting

islands closer to New Zealand, to which a name has already been given.

The extreme and average dimensions among nine males and eight females measured by Falla are as follows:

Wing, 226–278 (257.6); tail, 102–150 (126.3); exposed culmen, 31–37 (33.9); tarsus, 16.5–18 (17.5); middle toe and claw, 22–25 (23.6) mm.

Sterna vittata bethunei

Sterna bethunei "TRAVERS" BULLER, 1896, Trans. and Proc. New Zealand Inst., XXVIII (1895), p. 348 (Bounty Islands).

Sterna vittata bollonsi MATHEWS AND IREDALE, 1913, Ibis, p. 244 (Sub-Antarctic Islands of New Zealand).

So far as can be judged from the material, a single form of *S. vittata* inhabits all the sub-antarctic islands close to New Zealand. In addition to five Whitney Expedition birds, I have seen nine others, the source of the 14 adults being as follows:

Bounty Islands, 2 (February); Antipodes Islands, 5 (February); Campbell Island, 2 (June); the Snares, 4; Chatham Islands, 1. The last, if correct as to source, would represent a new record, but since it is a bird in the Rothschild Collection without other data than the alleged locality, it would be well not to place too much credence in it.

The subspecies is light in hue, generally resembling *tristanensis*, but the tail is markedly and consistently shorter and the feet apparently smaller than in the latter race. The New Zealand area is isolated rather by pelagic space than by zonal barriers from the islands of the Indian quadrant, and the extent of the distinction between the terns of St. Paul and those of Bounty Island deserves further study. The additional task of an adequate comparison of *bethunei* and *macquariensis* may prove practicable for New Zealand ornithologists.

Mathews and Iredale have applied a new name (*bollonsi*) to this tern on the ground that Buller's name (proposed in manuscript by Travers) is a *nomen nudum*. This is not quite correct, however. Even though Buller considered the Bounty Island bird to be identical with the form inhabiting Kerguelen, he presents at least a brief characterization and associates the type specimen with a definite locality. Many accepted technical names derive from less practical original descriptions than this.

Mathews and Iredale state that examples of the race differ from topotypical birds in their lighter coloration above and below, and probably in a shorter wing measurement. The distinction in shade is undeniable but, like that of wing-length, it holds also for the race described from Macquarie.

6 males from the Antipodes and Snares islands: wing, 250–259 (256.5); tail, 124.6–138 (130); exposed culmen, 35.1–37.5 (36.5); tarsus, 18–19.5 (18.8); middle toe and claw, 23.5–25.5 (24.3) mm.

3 females from the Antipodes and Snares islands: wing, 250–270 (260); tail, 119–136 (127.5); exposed culmen, 32.3–38.4 (36.2); tarsus, 18.4–19.5 (19); middle toe and claw, 23.7–24.6 (24.3) mm.

Sterna vittata georgiae

Sterna vittata georgiae REICHENOW, 1904, Orn. Monatsb., XII, p. 47 (South Georgia); MURPHY, 1936, p. 1109.

The addition of the Berlin examples of the South Georgian tern to the fine series in the American Museum Collection has given me a satisfactory total of 35 specimens of this form to use as a basis for my studies. Measurements of 26 adults show that this is the smallest race within the species, the lesser size being especially notable in the length of bill and tarsus. It is a long-winged form, despite its diminutive size, but its bill, legs, and feet are relatively as well as absolutely small, and the streamers of the outer rectrices never show a development comparable with that in the neighboring sub-antarctic race (*tristanensis*). Furthermore, the measurements indicate that sexual dimorphism among terns of this group is very slight, being detectable, indeed, only in the bill. The average length of the culmen among females of the South Georgian race is less than 2 mm. shorter than among males.

The fact that the smallest form of *vittata* inhabits South Georgia, whereas by far the largest form (*gaini*) occurs in the not distant South Shetland Islands and those of the West Antarctic chain, suggests how unjustifiedly the subspecific name *georgiae* has been applied to the breeding tern of the South Orkney Islands (Peters, 1934: p. 333; Ardley, 1936: p. 373). I have seen no specimens from the latter archipelago and hence can throw no new light upon the subject, but it is certain that no critical data have yet been published which would justify the identity of the South Orkney resident tern to a subspecific degree. For the present, *georgiae* should be considered as endemic at South Georgia and the South Orkney tern as of an unknown race.

18 males: wing, 246–270 (257.6); tail, 123.4–137.5 (129.2); exposed culmen, 30–32.8 (31.2); tarsus, 16–17.8 (16.7); middle toe and claw, 20.1–22.5 (21.6) mm.

8 females: wing, 255–266 (262.3); tail, 121.2–134.7 (131.2); exposed culmen, 28.5–30.5 (29.4); tarsus, 15.9–17.5 (16.5); middle toe and claw, 21.2–23.9 (21.9) mm.

Sterna vittata gaini, new subspecies

Sterna vittata, subspecies, MURPHY, 1936, pp. 1105–1109 (West Antarctic Archipelago).

SUBSPECIFIC CHARACTERS.—Most closely resembling the subspecies *georgiae* but of comparatively huge size. In wing-length and bulk of body it is the largest representative of the species, but its bill, legs, and feet are relatively small, as in the South Georgian form.

TYPE.—Amer. Mus. Nat. Hist. 196219; ♂ ad.; Deception Island, South Shetlands; December 1, 1921; A. G. Bennett.

RANGE.—Specimens seen only from Deception Island, but the bird is recorded by Gain (1914: p. 89) from several other localities in the West Antarctic Archipelago, in which part of the world it has frequently though erroneously been reported upon under the name of *Sterna hirundinacea,* an exclusively South American species (Murphy, 1936: pp. 1095, 1105).

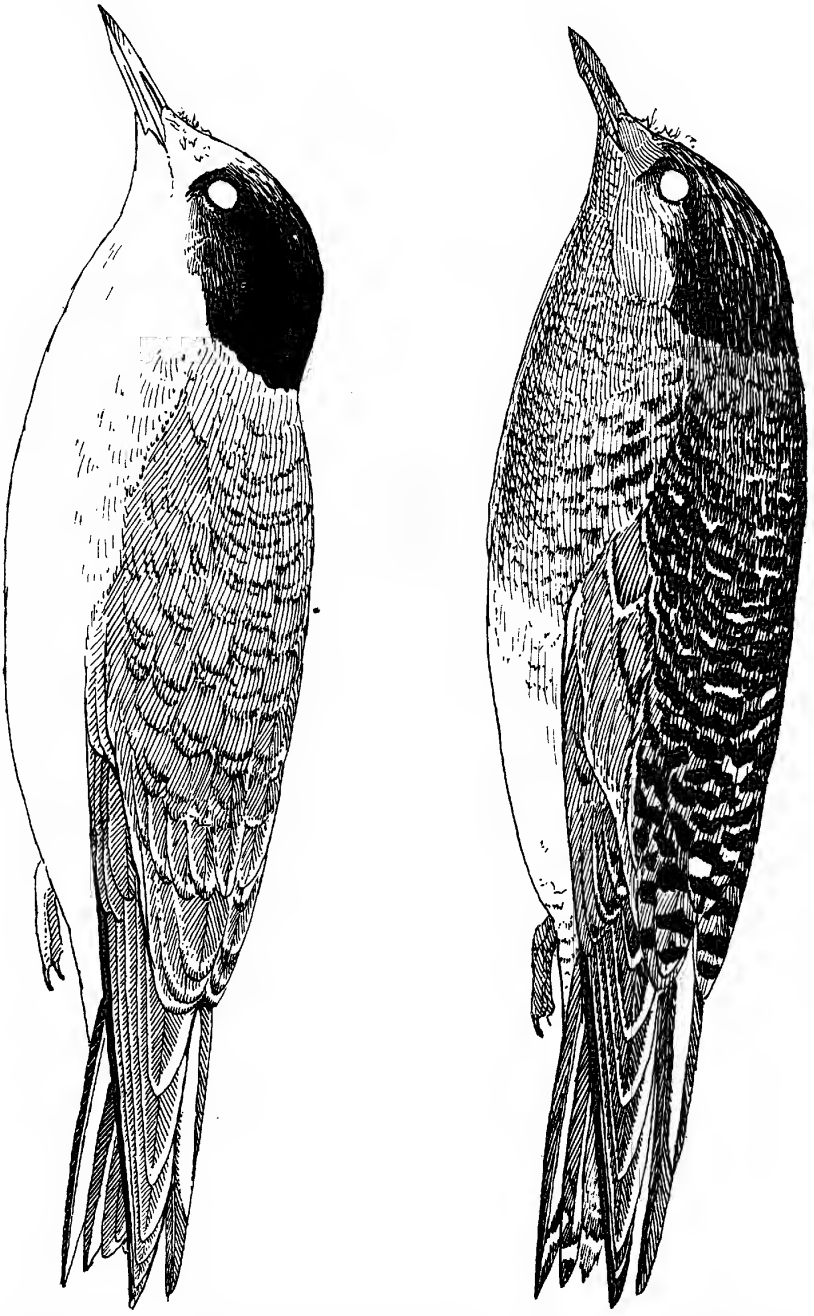
All available information about the form of *vittata* inhabiting the islands of West Antarctica has been summarized in 'Oceanic Birds of South America.' I take pleasure in naming this exceptionally well-marked subspecies in honor of Dr. Louis Gain, whose report on the birds of the Second French Antarctic Expedition, 1908–1910, is a monument in the annals of south polar zoölogy.

4 males from Deception Island: wing, 277–284 (281.5); tail, 146–156.7 (150); exposed culmen, 34.7–37.1 (36.2); tarsus, 18.3–18.8 (18.6); middle toe and claw, 23.2–24.6 (24) mm.

AFFINITIES SUGGESTED BY IMMATURE BIRDS

It is almost too facile to point out putative relationships between northern- and southern-hemisphere terns by means of comparing adults in breeding plumage. Thus *S. paradisaea* and certain races of *S. vittata* resemble each other about as closely as two distinct species well might. The similarity between the northern *S. hirundo* and the southern *S. hirundinacea* is somewhat less marked, but has been referred to by Saunders (1896: p. 53) and others. Such resemblances have led, indeed, to the not unnatural but entirely speculative assumption that the antarctic tern (*vittata*) first arose as a result of the establishment of southern-hemisphere breeding stations by transient arctic terns.

It appears, however, that in such a uniform and cosmopolitan group as the black-capped terns too much reliance may not be placed in adult resemblances as a criterion of close blood relationship. When young birds are compared, resemblances appear in new combinations, and a line of cleavage seems to separate the terns of the southern hemisphere from those of the northern hemisphere. The arctic tern, even in its



EQUIVALENT YOUTHFUL STAGES OF THE ARCTIC AND THE ANTARCTIC TERNS

Left: *Sterna paradisaea*, ♂, L. C. Sanford Collection, Amer. Mus., 3691, Pilgrim River, Alaska, July 27, 1911, R. H. Beck.

Right: *Sterna vittata georgiae*, ♂, Amer. Mus. Nat. Hist., 132549, South Georgia Island, January 11, 1913, R. C. Murphy.

Drawn by F. L. Jaques.

most heavily marked youthful stage, does not closely approach the very dark, transversely barred dorsal plumage of *S. vittata*, nor does it ever exhibit the buffy and gray speckling which covers the throat and upper breast in the juvenal stage of the latter species.

On the other hand, the dark down and dark juvenal plumage of *vittata* is of a type which is the rule among a whole group of southern-hemisphere terns. Thus the juvenal plumage in *hirundinacea*, *vittata*, and *virgata* has a surprisingly common aspect, young of the two former being almost exactly alike except as to size. Still a fourth southern species, *S. striata* of New Zealand, has a similar heavily barred and streaked buff-and-blackish dorsal surface when young, although its ventral plumage lacks the speckling which is so conspicuous in the other three.

It is not only curious, but is also a warning against jumping at conclusions, that the characteristics of youthful terns should be thus correlated with breeding ranges in one hemisphere, rather than with resemblances and apparent relationships of adults from nesting grounds on opposite sides of the equator.

Among all forms of *Sterna vittata* and the two other species of terns treated in this paper a slight discrepancy in size appears to be correlated with sex, males being on the average a little larger than females, at least in the length and diameter of the bill. Since, however, the labels of so many of the 95 specimens listed on pages 3 and 4 lack sex determination, I have disregarded this item in preparing the accompanying table of comparative measurements of adult terns.

Average Dimensions, Adults of Both Sexes, Pan-Antarctic Terns

	Wing	Tail	Culmen	Bill from Nostril	Mandibular Gonys	Depth of Bill at Base of Culmen	Tarsus	Middle Toe and Claw
Sterna virgata								
14, Kerguelen Island	257	129	28.1	18.1	13.5	7.9	18.1	23.3 mm.
Sterna paradisaea								
8, circumpolar pan-antarctic seas	259	147	31	23.3	18.2	7.7	15.9	22
17, Atlantic and Pacific coasts of South America	254.5	143.6	30.9				15.6	22.3
Sterna vittata vittata								
2, Kerguelen Island	267	139.5	33	22.5	16.7	9	18	23.5
Sterna vittata tristanensis								
9, St. Paul, Gough, Tristan da Cunha, and oceanic	258	172	36.5	26.4	20.4	9.1	19.5	26.6
Sterna vittata bethunei								
14, Antipodes, Bounty, Campbell, Snares islands	258	134	36.4	25.8	19.3	9.2	18.9	24.3
Sterna vittata georgiae								
26, South Georgia	259	130.5	30.6	20.8	16.2	7.6	16.7	21.8
Sterna vittata gaini								
4, Deception Island, South Shetlands	281.5	150	36.2	25.7	19	9.3	18.6	24

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